which has previously come before my notice in cases where other minds have looked at this same question—I venture to think you will allow me a few lines to show from what it arises, in the hope of expounding a subject which, popularly understood, must undoubtedly appear a little complex.

If, instead of taking the "concrete equivalent" of the definition, which the Professor has taken, though it is only used in the original "for our present purpose," we take "the broadest and most complete definition of life," . . . "*the continuous adjustment of internal relations to external relations*" ("Principles of Biology," vol. i. p. 80), we shall find that the changes undergone by minerals, even the physiological changes, will not obviously come within it; for it appears to me that, in the illustrations named in last week's NATURE, the minerals only display a continuous adjustment of internal *changes* to external *changes*. A change in the incident forces produces a change in the internal molecular arrangement of the mineral; a further change in the forces is *followed* by a further molecular, or molar, rearrangement in the mineral, and so on. There is no *anticipatory*, or *induced, change*—this is the point—in the mineral, which will correspond with the change which usually is connected with, and is sequent upon, the first environmental change, as is the case with living organisms. A quotation from the "Principles of Biology" (vol. i. p. 79) in conclusion will, I hope, now make my meaning clear. "If a creature's rate of assimilation is increased in consequence of a decrease of temperature in the environment; it is that the *relation* between the food consumed and heat produced, is so re-adjusted by multiplying both its members, that the altered *relation* in the surrounding medium between the quantity of heat absorbed from, and radiated to, bodies of a given temperature, is counterbalanced. If a sound or a scent wafted to it on the breeze, prompts the stag to dart away from the deer-stalker; it is that there exists in its neighbourhood a *relation* between a certain sensible property and certain actions dangerous to the stag, while in its organism there exists an adapted *relation* between the impression this sensible property produces, and the actions by which danger is escaped." The importance attaching to the word *relation* in this quotation has led me to emphasise it by italics.

Churchfield, Edgbaston F. HOWARD COLLINS

Oldhamia

PROF. SOLLAS's ingenious suggestion as to the origin of *Oldhamia* (NATURE, p. 515; Proc. R.D.S. p. 355) undoubtedly deserves very careful consideration; but it appears to me to leave some serious difficulties unexplained. For instance, the following occur to me after reading his paper and after examining two very fine specimens—one of *O. antiqua*, the other of *O. radiata*—recently placed in my hands by Mr. R. H. Scott, F.R.S.:—(1) The "puckerings," which are supposed to simulate the organism, are more definite in their boundaries than is usually the case with the ridgy or wavy "rucking up" which often occurs in phyllites as a first stage in the production of *Ausweichungsclivage*. (2) While I can trace down into the mass of the slate a certain puckering, I am at present unable to connect it with the *Oldhamia* visible on the upper surface. (3) As Prof. Sollas himself remarks, it is difficult to account for the peculiar branching form of *Oldhamia*. As it happens, during the last two or three years I have seen many examples of puckered phyllites, but never met with anything like *Oldhamia*. This difficulty in the case of *O. antiqua* seems to me almost insuperable. (4) In some cases I can detect two sets of markings crossing one another, so that the surface of the stone shows a reticulate structure, one set of lines being less definite than the other. This looks very much as if one branch of an organism were lying on the top of another; but I cannot account for it by mechanical movements alone. (5) The constancy of character in the markings is also a difficulty. One would expect every stage of development from the least to the most imitative. Now, though the *Oldhamia* is often indistinct, it certainly seems to me more like bad preservation than imperfect development of a structure.

Of course I do not in the least question the accuracy of the observations made by Mr. Teall and Prof. Sollas on the structure of the Bray Head rock; I only doubt whether the relation of this to *Oldhamia* can be regarded as proved. However, I am having some slides prepared from the above-named specimens, and hope that they may help in solving my difficulties.

23 Denning Road, N.W., April 5 T. G. BONNEY

Disappearance of Bishop's Ring in Colorado

THE reddish ring about the sun first distinctly appeared here (at the base of Pike's Peak) on November 22, 1883. For several days before that date, a faint discoloration of the region about the sun had attracted my attention. This gradually grew more intense, and, on the day mentioned, became unmistakable. The subsequent history of Bishop's ring as seen at this place is, in brief, as follows:—

The colour was most intense during the winter of 1883–84, and diminished in brightness from that time until its disappearance. At first it was visible almost all the time. Later, it appeared only at the time of cold storms, which were accompanied by great vertical movement of the air, or when, for any reason, the clouds reached to a great height. It was, on the average, brighter during the winters than in the summers; also, it was brighter when the sun was near the horizon. Many times in cold weather there has been not a trace of the ring, although the air was so clear that peaks a hundred miles distant were distinctly visible from the heights behind this city. At other times the ring has been very bright when the air was so hazy that the mountains only ten miles away were hardly visible. During the later months of 1885 it was invisible most of the time, but suddenly flamed out in wonderful intensity at the time of the great norther of January 9–11, 1886. Then for about two months it frequently appeared in the morning, or towards evening. During the warm months of 1886 it was not seen. On October 15 it appeared distinctly. About a week later it appeared very faintly a few times, and since then I have not been able to see a trace of it. My observations have been made at elevations of from 6000 to about 13,000 feet, and there was but little apparent difference in intensity at the different elevations. It is well known that the atmosphere here is, in general, very dry and transparent.

The diffraction-ring was often more coppery, almost rosy, in tint at the time of the northers, and in the thickening haze in the upper air preparatory to hailstorms. The great intensity of the colour at such times, and its peculiar tint, and that, too, irrespective of the amount of haze in the lower atmosphere, makes it probable that the ring was in part due to diffraction on ice-particles. If so, the ice-particles may themselves have been due to precipitation on dust-particles. The fact that no diffraction-ring has been seen around the sun during the past winter is not conclusive, for we have had no great northers, the season being unusually mild. But the disappearance of Bishop's ring for so long a time makes it certain that, even if there can be a circumsolar glow due to diffraction on ice-particles, yet the proper conditions for such a ring are realised only rarely, except when there is a great amount of volcanic dust in the air.

Colorado College, Colorado Springs G. H. STONE

Iridescent Clouds

SEVERAL brilliant displays of iridescent clouds have appeared here during the past winter. One, on January 19, lasted for more than two hours during a "Chinook" wind. A mass of closely-connected cirro-cumulus clouds formed at a great elevation directly over the eastern base of the Rocky Mountains, and thence extended eastward as far as the eye could reach. The western sky was clear. As the clouds drifted slowly eastward, new clouds formed along their western border. The western limit of the clouds was for several hours nearly stationary, then slowly advanced westward opposite the direction of cloud-motion. Along the western border of the clouds were many projecting tongues of cloud. At one time I counted seven complete spectra at the thinner parts of the clouds—all showing bands of red, green, and violet. There were also about twenty-five spectra showing only one or two of the colours. The larger of these iridescent spots were about 10° in diameter, and they varied in distance from 5° to more than 45° from the sun. Their tints were intensely brilliant. There were also great numbers of minute iridescent spots where the colours were in great confusion—a phenomenon which is very common here. They sometimes are so numerous as to simulate Bishop's ring.

Colorado Springs, Colorado G. H. STONE

A Claim of Priority

IN connexion with the letter of M. Ventosa headed as above in your issue of March 31 (p. 513), I should be glad if you would let me refer to a note which was appended to my paper

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on "Continuous Calculating Machines," in the Philosophical Transactions of the Royal Society, part ii., 1885.

This note, whilst giving due priority to M. Ventosa in the matter of *one* of the two features of the sphere and roller integrator, described in the above paper, a feature at which I need scarcely say I arrived quite independently, points to the fact that this forms but a part of the integrator in question. When combined with the other portion, that integrator is a calculating machine in the widest sense of the term. I have shown that in addition to giving the value of

$$\int ydx,$$

where y is any linear function of x, other varieties of the mechanism obtain the value of such expressions as

$$\int F_1(x)F_2(x) \ . \ . \ . \ F_n(x)dx,$$

and

$$\int\int \phi(x,\ y)dydx,$$

and also by a converse process give approximately the value at any instant of R where

$$R = \frac{dy}{dx}.$$

I had not before to-day seen the paper of Mr. F. J. Smith in the *Phil. Mag.* (August 1886), referred to by M. Ventosa. On pp. 381 and 382 of my paper above alluded to will be found a description of an integrator which is practically identical with that of Mr. Smith, as I have no doubt he will admit when he reads that description. With that integrator *hollow* brass balls were employed for the very purpose suggested by Mr. Smith. The instrument was, however, abandoned in favour of more convenient forms, one of which was actually employed by that gentleman upon his "ergometer" at the Inventions Exhibition, together with some very ingenious integrators of his own design. There is, I would say, one point of difference between the integrator described by Mr. Smith, and that by myself. The movable arm in the former appears to be guided by a pin in a straight slot. Now in the "sine" form, of which this integrator is an example, this pin should move in the arc of a circle, and it would be interesting to know if approximately correct results have been obtained with what is in some respects a more convenient practical device.

H. S. HELE SHAW

University College, Liverpool, April 9

The Vitality of Mummy Seeds

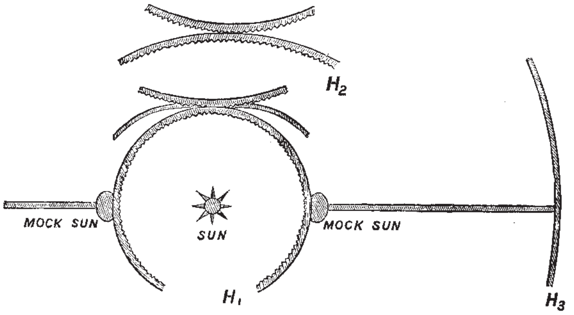
I READ with much surprise in NATURE of March 31 (in Prof. Judd's defence of his statement as to the longevity of seeds) that "competent botanists have cited the case of the germination of seeds taken from ancient Egyptian tombs as authentic." Many experiments have been made as to the length of time seeds may retain their power of germinating, by Robert Brown, Henslow, and others, with interesting results as to the longevity of some; but my impression is, and I venture to make it public, that competent botanists have universally condemned as utterly worthless the evidence given in support of alleged instances of the germination of mummy seeds. No scientifically responsible person has, so far as I am aware, put the fact on record. In these circumstances, therefore, the results of the successful experiments referred to farther on by Prof. Judd as having recently been made, possess the greatest interest, and botanists will look forward eagerly to the details which it is to be hoped will soon be made public. Hitherto the fruitful source of error has been the deception at the outset of the credulous experimenter by the Arab. In fact, the mummy wheat of one well-known traveller grew up in the form of *oats*--a plant not cultivated by the ancient Egyptians, but now grown in the land they inhabited—though this did not shake his faith in the genuine source of his supply. In the present case, however, the statement made in faith by so high an authority as Prof. Judd leads us to anticipate that the undertaking has been hedged in with all the safeguards demanded by a pure cultivation of undoubtedly genuine material.

GEORGE MURRAY

7 Onslow Place, South Kensington, S.W., April 5

Solar Halos

IN the forenoon of March 6 the sun was surrounded by a series of halos of the form shown in the diagram. The side of each arc, marked with a wavy or saw-toothed outline, was red, and the opposite edge blue; but no colour at all was visible in the horizontal belt nor in the farthest-out halo (H_3). This sketch shows the appearance at about 9 a.m.; as the sun rose higher, the horizontal belt got a curve upwards at each side—*i.e.* it continued to be parallel to the horizon—and was prolonged inside H_1 till it almost touched the sun. The two mock-suns were distinctly on the outside of H_1, and were coloured red next the sun, and blue outside, their reds about coinciding with the blue of H_1. The following are some of the measurements:—



	°	′
Sun to western mock-sun	23	46
,, eastern ,, ...	23	42
,, H_3 (two measurements)...	79 81	56 23

The halo H_3 has, I believe, been very seldom seen, and there are only three estimates of its radius on record: two of these make it 90°, and the third makes it 85° to 90°. It will be seen that our measurements—both about 81°—are considerably less than any of the former ones.

R. T. OMOND

Ben Nevis Observatory

On the Character of the Beds of Chert in the Carboniferous Limestone of Yorkshire

IT may be of interest to geologists to know that I have lately ascertained that the beds of chert which occur in the limestones of the Yoredale series of Yorkshire are distinctly of organic origin, and that, in fact, they are composed of the heterogeneously-mingled spicules of disintegrated siliceous sponges. The beds vary from 3 inches to 18 feet in thickness, and the limestones in which they are interbedded are nearly exclusively composed of the broken-up remains of crinoids, thus showing a well-marked alternation of periods in which sponges and crinoids succeeded each other. The spicules can only be studied in thin microscopic sections of the rock; in some cases they are very perfectly preserved and their axial canals are clearly shown; in other examples only very faint outlines can be made out. They appear to belong for the most part to the same group of Hexactinellid sponges as the recent genus *Hyalonema*, but Monactinellid spicules, like those of the existing genus *Reniera*, are also very numerous in some of the beds. Such an enormous accumulation of the debris of siliceous sponges proves that these organisms were as abundant in the Carboniferous as in the Cretaceous seas.

The beds of chert referred to are exposed near Harrogate, and at Richmond, Yorkshire, and they are remarkably developed at Arkendale, about fourteen miles above Richmond. I am indebted to Mr. J. G. Goodchild, of the Geological Survey, for directing my attention to this last-named locality. Owing to their resistant character, fragments of the beds are also widely distributed in the boulder-clays to the south of their outcrops, and I have met with them in these clays near York.

It has been known for some time that the remains of siliceous sponges are of common occurrence in the Carboniferous chert beds of Ayrshire and of certain parts of Ireland, but they do not appear to have been noticed hitherto in the corresponding beds of Yorkshire. I hope shortly to give a more detailed description of their principal characters.

GEORGE J. HINDE

Croydon, April 2

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